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ABSTRACT

The communication revolution has stimulated teacher education institutions in many countries in the world to integrate modern technology such as the Internet into their programs. However, just transferring traditional text-based materials to the World Wide Web is often counterproductive. This paper focuses on the experiences of 12 Sri Lankan teacher educators as they developed Internet-based study materials, while undergoing specialized postgraduate training at the University of Wollongong (Australia). As experienced teacher educators, yet novices to the Internet, each of them developed a Web study guide, targeting Sri Lankan teacher trainees. The study analyzed the ways in which the educators transformed information, the design patterns adopted, and the issues they faced. Initially the effects of limited knowledge and skills upon the development of instructional materials that made use of this new technology resulted in the development of limited educational strategies. However, as the experience levels rose, the design of learning experiences became more inventive, but more time was needed to influence the way the teachers thought about their learning and the learning of their students. (Contains 32 references.) (Author/MES)

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DEVELOPING INTERNET-BASED STUDY MATERIALS AS NOVICE WEB-DESIGNERS: EXPERIENCES OF TWELVE SRI LANKAN TEACHER EDUCATORS

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Abstract

The communication revolution has stimulated teacher education institutions in many countries in the world to integrate modern technology such as the Internet into their programmes. However, just transferring traditional text-based materials to the web is often counterproductive. This paper focuses on the experiences of twelve Sri Lankan teacher educators as they developed Internet-based study materials, while undergoing specialised postgraduate training at the University of Wollongong, Australia. As experienced teacher educators, yet novices to the Internet, each of them developed a web study guide, targeting Sri Lankan teacher trainees. The study analysed the ways in which the educators transformed information, the design patterns adopted, and the issues they faced. Initially the effects of limited knowledge and skills upon the development of instructional materials that made use of this new technology resulted in the development of limited educational strategies. However, as the experience levels rose, the design of learning experiences became more inventive but more time was needed to influence the way the teachers thought about their learning and the learning of their students.

Keywords
instructional design, web-based learning, novices

Introduction

Teachers are considered crucial in the successful utilisation of technology in education, and the modern teacher has to cater for students who often are active users of the Internet. These students have grown up with the technologies of the Internet, and readily adapt to them, whereas teachers, in contrast, face difficulties in this transition (Bigum, 1998). The successful utilisation of technology in education will depend on how the teachers are provided with the necessary training in technology-based teaching and learning competencies (Kimmel & Deek, 1996; Cornu, 1997). Despite the tremendous advantages of the new technologies in teaching and learning, much of the literature reveals that in reality progress is not as great as expected (Underwood, 1997; Bork, 1995). Not only are teachers observed to be reluctant in using new technologies such as the Internet in the classroom (Bigum, 1998), but University educators were also found to make little use of them (Collis, 1998a; Albright, 1996) and Collis (1998b) claims that 'there is a gap between vision and execution'. Many authors agree that changing the conventional instructional approaches used by teachers is not an easy task, and a 'resistance to change' occurs within the teaching profession (Underwood, 1997; Kennewell, 1997; Robinson, 1997). Although some studies into technological integration in schools and universities reveal that these approaches make a significant impact on educators (Woodrow, Mayer-Smith & Pedretti, 1997; Williams, 1997), it is

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also apparent that teachers often just use technology to substitute their existing instructional approaches (Kennewell, 1997; Barrowy & Laserna, 1997). Underwood (1997) believes the reason for this is that teachers' practices become more stable over time and maintaining the status quo becomes the norm. He suggested that, 'if change is to be brought about through experience, then that experience must not only be provocative, but it must be meaningful in both a personal and practical way to the teachers' (Underwood, 1997; p. 158).

Teaching and Learning with the World Wide Web

The world wide web (WWW) is increasingly being used as a medium for delivering instruction in the teaching and learning process. With its vast pool of resources and the hyperlinked environment that allows instant access to them, the WWW becomes a valuable tool for facilitating knowledge exploration by learners. Through making discoveries in this information-rich environment, learners can construct meaningful knowledge (Jonassen, 1995, 1996; Jonassen, Peck & Wilson, 1999). Despite the advantages, several concerns about web-based learning have also been raised. These concerns are either pedagogical issues related to teaching and learning, such as 'information overload' (Ryder & Hughes, 1997), navigation issues such as 'getting lost in hyperspace' (Khan, 1997), or technological issues related to hardware and software (Hill, 1997). Cross-cultural differences due to language, teaching and learning styles, and interaction and communication, may also affect the learners in a web-based learning environment (Collis & Remmers, 1997).

Designing Web-based Learning Materials

The features of WWW such as hypertext, graphics, sound and video, and the easy-to-use, point and click graphical interface provide an extensive environment for instructional designers to develop diverse types of learning materials. Many authors assert that careful consideration and analysis is very important when designing a web-based learning environment (Brooks, 1997; Khan, 1997; Ritchie & Hoffman, 1997). For example, Khan (1997) contends that the web has the potential to support well-designed instructional materials. Thus, the design and delivery of instruction via the web requires 'thoughtful analysis and investigation of how to use the web's potential...' (Ritchie & Hoffman, 1997; p. 138).

Brooks (1997) identifies the processes involved in preparing web-materials such as, 'webifying' written materials, adding hypertext links, adding multimedia and online tutoring. He asserts that these processes should be preceded by a planning stage, that includes developing goals and objectives according to the learner needs, deciding on content and developing appropriate activities and finally organising and arranging information. Instructional designers also face the challenge of creating motivational, interesting and productive web learning environments (Duchastel, 1997; Ritchie & Hoffman, 1997) and Starr (1997) identifies, hypertext, delivery of multimedia and high interactivity as three key features of a web environment. He suggests that it is important for the designer to develop an interface that incorporates 'human-computer interface design principles and not just transfer paper or previous non-graphical interfaces to the screen...' (p. 10). Several other authors recommend other features to take into consideration when designing web-based materials. These are mainly in the areas of organisation of information, orientation of the learner within the environment, navigation, interactivity and presentation. For example: keeping simplicity and consistency in the design and navigation, structure text to establish coherence, provision of real interactivity, and visual presentation without distractions are some common aspects identified (Oliver, Herrington & Omari, 1996; Shotsberger, 1996; Starr, 1997; Brooks, 1997; Hedberg, Brown & Arrighi, 1997).

The process of designing and producing instructional materials for the Web can force designers to engage in deep analysis and articulation of the content. In doing so they are also forced to reflect upon their knowledge in new and meaningful ways. Thus, designers function as learners and this is a very powerful learning experience (Jonassen & Reeves, 1996). Further, Hedberg et al. (1997) found that when the focus was on the learning process, less emphasis was placed on the refinement of production skills and more emphasis was placed on design. Gros, Elen, Kerres, Merrienboer and

Spector (1997) support the claims of Hedberg et al. (1997) and assert that previous experiences influence people when they are designing instruction and warn that "...novices at ID who rely on their classroom experiences, typically choose a rather static information delivery approach rather than a learning-support one."(Gros et al., 1997; p. 50).

Background to the Study

Sri Lanka is currently at the stage of integrating Internet-based teaching and learning into teacher education programmes. Under the World Bank sponsored Teacher Education and Teacher Deployment (TETD) Project, a number of teacher educators representing different teacher education institutions in Sri Lanka were awarded fellowships for staff development in overseas Universities, including The University of Wollongong, Australia. The TETD Project also proposed to establish a computer network among the National teacher education institutions (SLTETD Project, 1996). In the near future teacher education programmes in Sri Lanka can be expected to have Information Technology (IT) components integrated into them.

Purpose and Significance of the Study

The purpose of this study was to examine the design processes adopted by a group of Sri Lankan teacher educators, while they developed Internet-based study materials, as novice web-designers. During this process, each designer went through a unique experience where a transition from designing traditional text-based materials to web-based materials occurred. The insights gained through this study provided an understanding of how the teacher educators transformed traditional text-based materials to web-based materials and the problems they encountered in this process, as novice web-designers. Further, it was an opportunity to study specific design issues, associated within a Sri Lankan context. This would be a significant contribution, since Sri Lanka is currently at the preliminary stages of integrating Internet-based courses into higher education.

This investigation was limited to analysing experiences of a small group of twelve Sri Lankan teacher educators in their process of designing Internet-based study materials as novice web-designers, while studying in Australia. These findings cannot be generalised to all teacher educators. However, the findings do contribute to a body of information on instructional design issues faced by educators, in developing Internet-based study materials.

Method

Participants

The participants were twelve instructors from different teacher education institutions in Sri Lanka, who were familiar with using, designing and developing text-based study materials. At the University of Wollongong, they were enrolled in the subject, Information Technology for Education and Training, as a component of their Master of Education Degree Course, in which they were required to develop a web study guide. They were experienced teacher educators consisting of four females and eight males, in the age range of 30 - 45 years. All had more than ten years of experience in the teaching profession, either as teachers or teacher educators. Seven were B.Sc. graduates and the rest were BA or BEd graduates. All were professionally qualified and six had Masters Degrees. Most of them (8) have been involved in developing text-based study materials in Sri Lanka. Only three of the participants were competent in computer use, and only one person was familiar with Internet use. The others had very little or no experience in computer use and Internet use. None of them had designed or developed web-based study materials before. At the University of Wollongong, three participants (who had prior computer experience) were completing multiple IT subjects, majoring in IT for their Masters Degree, while the others were completing only one IT subject along with subjects from other disciplines.

Task

The common IT subject taken by all the participants was, Information Technology in Education and Training, in which they had to design and develop a web-based study guide on a topic of their

own choice, as an assignment. This is a basic IT subject which is mainly designed to prepare students to design, develop and evaluate teaching and learning materials using information technologies. Spread out in a thirteen-week time frame, this subject included both face-to-face and online sessions, with many hands-on experiences. The development of a web-study guide ("Guide") was the final project for this subject. It included three key areas; developing skills in terms of the software, conceptualising in terms of the content, and creativity in terms of the design and structure. This process took place in a constructivist environment, where the learners created their own understanding of the instructional design process, through the experience of it (Jonassen, 1996). The emphasis of the task was on the design and how to structure activities to engage learners. Hence, skill development was de-emphasised. Basic skills about creating web pages using Claris HomePage were introduced at an initial workshop held in week two. A collection of Guides developed by previous students were resources that could be studied and reviewed; the topics covered focussed on the theory and application of information and communication technologies for learning. Another workshop to clarify the problems encountered while developing the Guides was held in week ten. The students were encouraged to display their draft Guides and obtain feedback from peers and staff. In addition the instructors provided discussion on common issues, individual assistance and guidance when required.

Data Collection

Data was gathered from multiple sources during the process. A preliminary questionnaire was used to identify each participant's background information such as educational background, experience and subject specialisation. The course instructors were interviewed about the course background, including the knowledge and skill development activities which supported the task. The participants were observed while they were building their Guides and each was interviewed. These interviews made use of the Guides to stimulate recall. The aim was to understand how they planned and progressed through the process of designing and developing their Guides. Both electronic and hard copies of the developed Guides were analysed throughout the process, using a checklist based on instructional design principles. This enabled the specific design approaches adopted by each participant during the development process to be identified. The preliminary analysis identified some key themes. Final semi-structured interviews were held with the participants, in order to confirm these themes and previous information. Reflective reports of the participants, journal writings of the researcher and other artefacts such as course outlines were also used as sources of data.

Data Analysis

Data analysis continued throughout the study, starting with first data collection. The preliminary observation and interview data were primarily coded and categorised while examining for identifiable patterns. As the study progressed, the codes were reformulated, categorised and sub-categorised. The final-interview transcripts were also initially coded using the same coding procedure, and they were further analysed. The reflective reports and other artefacts were used to triangulate data, which facilitated further analysis of results. The data were finally organised under seven main categories: design patterns, planning methods, concerns, influences, issues, support and reflections. The twelve participants' design processes were written as twelve separate cases, based on the above categories. They were carefully examined for similarities and differences, and the design patterns were identified.

Results and Discussion

Process – Design and Development of Guides

Planning methods

In the planning stage of the task, the participants engaged mainly in defining a target group, selecting a topic, finding information and arranging information. All the participants identified either teacher trainees, teacher educators or students in Sri Lanka as the target audience of their Guides. Selection of a topic was based on the needs of their target group and it was mainly influenced by their professional and personal interest in a subject area. Some of them selected

specific topics directly from the Sri Lankan syllabi (e.g. Cement Production, Flowering Plants, Mathematics Progression), while the others opted to develop on some new areas they have learnt in their subjects (e.g. Reflective Practice, Clinical Supervision, Computer Mediated Communication). All participants started arranging information by mapping out the content on paper first. Many of them demonstrated a procedure of progressing from the "known to unknown": writing down on paper, word processing, creating web pages and copying the content into it.

Concerns

It was apparent that all participants attempted to make use of this task to develop materials that would be relevant and meaningful in their current profession and Anura's remark, "This topic is a new concept, which is needed to be introduced to Sri Lankan teachers" is an example. They were also concerned about gaining attention, retaining attention, motivating and facilitating the learners. All were concerned about developing their own knowledge and skills as the task was assessed and they wanted to obtain a good mark.

Influences

Numerous factors have influenced the participants at different stages in this process, mainly on selecting the topic, arranging information and inserting specific features in their Guides. The arrangement and presentation of information was influenced by the participants' previous experiences, as evident by following quotes:

> *I have many experiences as a teacher educator and a curriculum developer. I used those experiences mostly in developing this (Nimal)*

> *I was mostly influenced by the experience in writing modules (Anoma)*

On the other hand, the previous Guides were also influential. Anura's declaration, "I designed mainly by reviewing previous Guides" was shared by many others at the beginning, but later on some features were changed according to their own interests. However, Yamuna, Nimal and Karu claimed that they were not influenced by previous Guides. Yamuna declared that she did not even look at the other Guides until she developed hers. Epa tried to do something different because at the beginning the course instructors indicated they did not expect something identical to previous Guides. Many were also influenced by discussions with the course instructors who suggested changes to their Guide features such as reducing the length of information and changing the activity type. Learning theories and instructional models also had an influence in the Guide presentations to some extent. Except for Epa and Karu who directly claimed they followed a constructivist approach, the others responded that they did not follow any specific model.

Issues

At the beginning, some were not certain about the purpose of the task. Epa's remark, "I didn't quite realise what a Guide is", reflects this view. Frustrations at the beginning were explained by Nalini as, "There were instances when I came to work, but couldn't proceed, and there was no one to get help from, and I had to stop and go home". Epa said, "I had to learn by mistakes". However, their desire to accomplish the task motivated them to seek help from the instructors, peers or any others to solve their problems. A few changed their topics, because they could not find relevant images and lacked the skills to create them. Epa had almost completed developing his Guide on Factorisation, but changed later when he realised that this topic was not appropriate to present as a Guide. Many started with having a lot of information in the content at the beginning. However, after discussing with the instructors and learning more about Guide characteristics, many of them reduced the amount of information they originally planned to present. Limited technical skills were found to be a major issue faced by all, and novice computer users were affected the most. A strategy adopted by a majority (8) of teacher educators was to buy their own PCs, install the software and practice at home. Many of them agreed that this self-practice, using mostly trial and error methods, helped them immensely in building up their Guides.

Time limitations, work stress and tension were common constraints faced by all. The initial workshop was held in week 2, and the task was due in week 13. However, most of them started planning and designing at a late stage, since all were occupied with many assignments in three simultaneous subjects. Once started, most of them claimed they spent more time on this assignment, since they were very interested in this new subject area. In some cases participants were frustrated at being unable to implement their ideas in their Guide due to a lack of skill. For example, Anoma wanted to show the development process of cement using an animation, but could not do that.

Support

The two workshops were useful for all. The first workshop was useful to become familiar with the software and to start developing the Guide. The second workshop helped them to overcome the problems they encountered while developing the Guide. All were supported by the instructors and some had personal consultations with them to clarify problems. However, many tended to obtain support from peers. The reluctance of some to ask for help from instructors may be due to a cultural influence. On the other hand, the less technologically skilled people obtained help from more skilled people. Collaborative work played a key role in this process. Not only did it lead to the sharing of ideas, but also led to the sharing of resources. For instance, in some cases the same animated images were used by several persons in the group, and six people have shared external web resources to link in their Guides. This indicated a close peer relationship among small groups.

Reflections

The attitudes of the participants were observed to change during this process on creating a Guide. At the beginning most of them were uncertain and not confident about developing web materials, and comments such as, "I thought I wouldn't be able to do this satisfactorily", or "I was very much worried and afraid, thinking whether I would be able to manage this" were typical. At the end of the process, all twelve participants were very satisfied and confident in developing web-based study materials. Comments such as, "Now I think I can prepare any Guide" and, "I have a confidence that now I can do this" have replaced the early comments. Gaining "hands-on" experiences in using the new technology, and the satisfaction of developing their own web material, made a great impact on many, as all were novice web designers. Further, they were also very much motivated to use this experience in their profession, after going back to Sri Lanka, as reflected by Epa's comment, "Now I can contribute a lot to our distance education modules". They developed only limited skills in developing web materials, using one software application. Yet, the impact of this process was so high that the confidence level was raised to a much higher level, from a very low starting level. They also wanted to practice and share their knowledge and skills after going back to Sri Lanka.

Even the participants, who responded at the beginning that they did not intend to develop web-based study materials after going back to Sri Lanka, had a completely different attitude at the end of the process. The following comments expressed by Lal summarises the ideas shared by most of them, at the end of the process:

> *I never thought that I might have an opportunity to move forward with the new technology, during my working period...But now I have had an experience and I realise that these things can be done by us too.*

When asked whether there would be any changes in their Guides if they had to do this process again, all of the participants claimed that they intended to do so. Although most of them have presented their Guides following the traditional instructivist approach, several of them wanted to change their presentations to include more constructivist features, such as changing the activity types and allowing the learners to explore more by linking many external web sites as resources. Yet, a few did not want to change their instructional approach even in future productions, except for including more images and web links. However all the participants agreed that introducing Guides for teacher education in Sri Lanka is a very useful and an effective method of teaching and learning.

Product – Developed Guides

Arrangement of information

At the beginning, all participants identified some common basic components to be included in their Guides, which were An Overview/Introduction, Objectives, Topics/Sub topics, Activities, Feedback, Help, References/Resources. Many pointed out that there was not much difference between their presentations and text-based study materials and, in some cases, distance education materials, except their material had less content, included more activities, varied the placement of activities and included motivational features available in a web environment. However, during different stages of the process, several changes were made in their presentations. Whilst it was difficult to categorise the Guides as instructivist or constructivist, the final versions of the Guides displayed two distinct approaches in the arrangement and presentation of information. These were called, 'a traditional instructivist approach' and 'a less traditional more-constructivist approach'.

Features	'Traditional' approach	'Less-traditional' approach
Presentation of Information	Lengthy descriptions	Brief descriptions
Learning Strategy used	Reading from screen	Finding out information using the resources
Learning Environment	Sequential order in presentation of topics	No sequential order
Flexible environment		
Use of Activities	To recall or apply facts	To engage users to build up learning
External Web links	One as a resource or none	Many linked to support activities
Approach to learning	An instructional approach	An exploratory approach

Table 1: Some examples of features observed in the two types of web study guides

A majority (10/12) described their Guide as an "Instructional guide" or a "Self-study guide". The learning strategy applied in most of these was to provide some information, give some questions as an activity, provide answers as feedback, and indicate some resources at the end to obtain further information. The information was presented as descriptions to be read from the screen, similar to a book. However many participants asserted that this information was essential and Nalini explained that, "For the learner who is learning in isolation, we should provide all the information in our guide". However, they also tried to include some features that they learnt in the course as suitable in a web environment, such as reduced content, small chunks of information, flexible hyper linking and different activities, to make it 'different from a book' (Epa).

Only two people, Epa and Karu, attempted to deviate from this 'traditional' approach. These Guides provided only brief points on the topic and used activities to engage learners in finding out information and building up understandings. Epa declared that, "This is just providing some brief information to find out other information sources...There is a great deal to explore here", and further explained, "I was mostly influenced by the constructivist approach, but I was unable to accomplish it completely." Both of them started planning their Guides in the familiar instructivist way but Karu changed his approach in the planning stage itself, whereas Epa almost completed developing an instructivist Guide, before started on a new constructivist-based Guide. They were more competent computer users and were also prepared to take a different approach from what they were accustomed to. Also they understood the basic features of a constructivist learning environment (introduced in the course). Further these two Guides presented information in a non-sequential manner, whereas the rest of their group directed the learners in a sequence and their Guides were really 'electronic' books.

Activities

All participants had used activities and feedback in their Guides with different intentions. The most common purposes stated by the people who took an instructivist approach were to, "recall facts" or "apply the learnt facts". In these cases, the activities were considered as self-evaluations to "reinforce learning". Some included activities for students to find out information from other

sources yet did not facilitate that by providing links to any resources. The learners were expected to seek facts by reading books, or through feedback that provided direct answers. In the more constructivist environments, the activities were used in a different way. Epa provided activities for the learners to find more information on the topic. Karu's Guide allowed learners to build up their own learning through group activities, and feedback was given only as some guidelines. In all the other instances feedback provided answers to the questions.

Karu had linked many external web resources for that purpose. Only this Guide allowed group interactivity through an online discussion area, supporting collaborative learning. There were only two other instances where the learners were given the opportunity to interact with the instructor via email or a feedback form.

Of the twelve participants, only three who were majoring in IT had many external web sites linked to their Guides as resources for learners. Six had a single common web site linked to their Guides without an indication of its relevance to the topic. This was mainly done as an assignment requirement rather than a need of the Guide.

Added features

Features such as images, animations, different backgrounds and font colours, were included by everyone. Some had different background colours, one for each page, and many font colours, to "motivate the learners". Others used a few different coloured backgrounds to indicate different sections and different font colours to specify concepts. Some used a single background colour to keep it "academic" and used this claim to explain the limited number of images and animations which they stressed were unnecessary. As Nalini explained, "They (the learners) are not children. I didn't need to include pictures and animations to gain their attention." Some also thought that their Guides should be 'academic' because of the intended audience. In contrast, people who did include many images and animations claimed that they used them to increase the motivation of the learners and to gain their attention. Anura who found one animated image by accident, later on inserted quite a large number of animations in his Guide "to practice" them. He stressed that these and many other features in his Guide, such as scanned images and external web links, were mainly included for practising rather than academic purposes.

Conclusion

The results reveal that all participants started planning their Guides as traditional text-based presentations that they were accustomed to. However, during different stages of the process, they attempted to change their approaches in different ways. This occurred as they gained knowledge and skills in using the technology. Even though they had to overcome many pedagogical, technological and cultural issues, all managed to complete the task within the time limit. This study outlined an evolutionary process of designing web-based learning materials by a group of novice web designers. Each individual's design process was a unique experience, influenced by many factors such as previous experiences, skill level, assessment and cultural influences. But, despite the intention of all to develop something different from their conventional approaches, most of the products portrayed the same traditional instructivist approach (except for the addition of web features such as hyperlinks and images). These findings support those reported by other researchers (El-Tigi & Branch, 1998; Maddux, 1998; Gros et al., 1997).

The participants had used an instructivist approach to learning all of their careers but in this task they were encouraged to develop a Guide that was based on a constructivist approach to learning. This was a new approach and contradicted many of their strongly held beliefs about learning. Further, the participants were also novice users and this factor caused a majority of participants to follow procedures and use familiar learning strategies. Two participants, who were more confident with the technology, attempted a constructivist approach. In their case, being immersed in the technology-based teaching-learning environment caused them less cognitive load than their peers. As a result, they did not have to exert as much mental effort to use the software. This may have

given them the opportunity to experiment with a constructivist approach in their Guides. The desire to be skilled in this new approach and to experiment the multimedia aspects, rather than being concerned about the learning aspect of their Guides, can be related to the excitement of the first experience in using a web-authoring tool. There were also a few people who despite having this experience did not want to change their approach in teaching and learning. These observations support the views expressed by Bigum (1998), Underwood (1997) and Kennewell (1997) on the difficulties in changing practices of experienced teachers. Further, the willingness of many to change from their traditional approach to a more constructivist approach in the future may indicate that they are starting to think in a new way. However, we acknowledge that it is unlikely that a complete transformation of approach will occur after just one experience of developing a Guide. It will take multiple experiences of producing web materials to gain a thorough understanding of the process.

When integrating web-based teaching and learning into teacher education programmes, it is important to recognise that we are not only introducing new technologies but also new approaches to teaching and learning. Just making the educators familiar with the technology is not enough. A more fundamental issue is the way the teachers think about their learning and the learning of their students.

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